PANEL DISCUSSION II: Alternative Propulsion

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In order to keep its “Permit to Fly”, the aviation sector has to dramatically reduce its emissions, both CO2 and non-CO2. Next to continuous improvements in the classical aeronautical disciplines such as aerodynamics and lightweight structures, alternative propulsion will be key to this change. In view of in-flight environmental impact, batteries would be ideal, as they produce no emissions during operation. But given the specific energy density of battery chemistries currently available, this is prohibitive for economically viable aircraft with powertrain architectures using significant energy hybridization based on batteries. The H2020 project FutPrInt50 has shown that the tipping point for battery technology would be in a region of 700WH/kg – about 3 times the performance available today. Also fuel cells have a real zero carbon balance, as water as the only by-product is assumed to have no significant impact at the typical flight altitudes, i.e. up to 27.000ft, mainly due to an intense vertical exchange in this layer of the atmosphere. However, we still need a better understanding of the actual climate impact of water emissions in these altitudes. Direct combustion of hydrogen is of interest for larger aircraft, but it has to be ensured that the NOx emissions are well controlled in this process. SAF will be the exclusive fuel for long range aircraft also for the long term, as hydrogen is disadvantageous both due to its low volumetric density as well as due to the weight of the tanks required to safely store liquid hydrogen. An issue for both hydrogen and SAF will be the availability in the quantities required for the aviation sector on a world-wide scale. Certification of novel power train components and architectures is part of the transversal Clean Aviation project CONCERTO, aiming at preparing both technologies and regulations in parallel for a smooth market introduction. Given the impressive complexity of novel powertrain architectures, safety assessments easily can lead to significant weight increases related to the redundancies required for safe operations with failure cases, as shown for example in the Clean Aviation project HyPoTraDe. Clean Aviation currently is in its first phase of preparing the demonstrations required for a large number of technology bricks, aiming at full scale demonstration in the second phase. In general, I strongly believe in a step-up approach over time from General Aviation class aircraft to 19 seat commuters, smaller regional aircraft with a capacity of 30-40 seats, larger regional aircraft with 60-80 seats and finally, to short-medium-range aircraft with a capacity of around 100-150 seats. And to conclude, while today we are very much focused on short-term impact, it is paramount that in an upcoming 10th Framework Programme there is a pillar for upstream research to fill the pipeline of fresh ideas in the field of alternative propulsion, not so much oriented towards immediate demonstration, but on alternative technologies overcoming issues of the first generation of power train components currently in development and demonstration.